PROVIDING MULTIPLE PERSPECTIVES FOR A VENUE ACTIVITY THROUGH AN ELECTRONIC HAND HELD DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application Serial Number 60/243,561, filed ***October 26, 2000*** by Luis M. Ortiz and Kermit D. Lopez, for "Providing Multiple Perspectives for a Venue Activity through an Electronic Hand Held Device."

BACKGROUND OF THE INVENTION

1. Technical Field of the Invention

The present invention is related to wireless electronic hand held devices, such as Personal Digital Assistants (PDAs), hand held televisions, and data-enabled wireless telephones. The present invention also relates to techniques for remotely delivering video-related data to hand held devices. In addition, the present invention relates to techniques for providing increased viewing opportunities for audiences in venue environments, such as stadiums and concert arenas. Additionally, the present invention relates to wireless video data transmission to hand held devices.

2. Description of the Related Art

Most modern stadiums and live entertainment facilities or arenas (herein also collectively referred to as "venues"), which feature sporting events and concerts, typically employ large television screens that

receive video images and are linked within the stadium to a plurality of television cameras positioned to capture video images at diverse locations within the stadium. The audience at a typical sporting event, for example, can generally view advertisements, instant replays, and other sports related data on the large television screens within the sports stadium itself. Feeds are additionally generally provided from the cameras to announcers in a broadcast booth, replaying certain plays from the event so that the announcers and can make comments about plays, and finally transmitting a telecast to the viewing audience, including some aspects of captured video and data to the stadium audience.

Despite the availability of such large screen television monitors, venue event audience members still lack enhanced viewing options or perspectives within the stadium itself. To compensate for the lack of viewing options, sports and concert promoters often rent binoculars to audience members prior to or during the event. Such binoculars can permit the typical audience member to obtain a somewhat better, but limited, view of the event, such as a football or hockey game, but even these views are often obstructed by other audience members and are tied to only one perspective.

The large television screens placed in the stadium are typically linked to cameras that are either fixed and mobile, the placement of the cameras about the stadium or venue are generally tied to an enterprise system. The movement of the game ball in a football game, for example, along with the players on the field

is dynamic and unpredictable, and may not always be caught by the active camera having the best perspective. Thus, during a game, the large television screens typically provide only one view, which can be obstructed further by other players or officials, often destroying a critical angular view.

In addition, such large screens are often utilized to bombard audience members with advertisements, thereby cutting into data such as instant replays at a time when an audience member might otherwise wish to view instant replays, a current play or other event data. The audience members, therefore, essentially view the large screen at the behest of the camera operator and cannot select their own views or camera angles.

Based on the foregoing, the present inventors have found that such problems in venue environments can be solved through the use of hand held devices, such as PDAs, data/video-enabled cellular telephones, and other hand held wireless video-enabled devices. For example, the recent shift in the consumer electronics industry from an emphasis on analog technology to a preference for digital technology is largely based on the fact that the former generally limits the user to a role of a passive recipient of information, while the latter is interactive and allows the user to control what, when, and how he or she receives and manipulates certain information. This shift in focus has resulted in the development and increasingly widespread use of a digital device generically referred to as a "personal digital assistant" (PDA).

These devices are hand held computing devices (i.e., hereinafter referred to as "hand held devices" or "handheld devices") that are becoming increasingly popular for storing and maintaining information. Although PDAs may be connected to a desktop personal computer or other PDAs via infrared, direct wire, or wireless communication links, PDAs and similar hand held devices, can be linked to remote networks, such as the internet, or local wireless resources, through available wireless communications techniques.

The most advanced data- and video-enabled wireless communication devices currently available in the marketplace take the form of a PDA (such as the Palm OS, Handspring OS, and Windows CE compatible hand held computers). Unlike personal computers, which are general-purpose devices geared toward refining and processing information, PDAs are designed to capture, store and display information originating from various sources. Additionally, while a certain level of skill is required to use a personal computer effectively, PDAs are designed with the novice and non-computer user in mind.

A typical PDA includes a microprocessor, memory unit, a display, associated encoder circuitry, and selector buttons. It may optionally contain a clock and infrared emitter and receiver. A graphical user interface permits a user to store, retrieve and manipulate data via an interactive display. A PDA may also include a calendar, datebook, and one or more directories. The calendar shows a month of dates organized as rows and columns in the usual form. The

datebook shows one day at a time and contains alphanumeric text entered in free format (typically, with a time of day and an event and/or name). Each directory contains entries consisting of a name field and a free form alphanumeric text field that can contain company names, addresses, telephone and fax numbers, email addresses, etc.

Entries may be organized alphabetically according to the name field and can be scanned or searched for by specifying a specific sequence of characters in the name field. A menu displayed via the graphical user interface permits a user to choose particular functions and directories. Most PDAs come equipped with a stylus, which is a plastic-tipped pen that a user utilizes to write in, for example, a "graffiti area" of the display and tap particular graphically displayed icons. Each icon is indicative of a particular activity or function. Touch screen interfaces, however, are also increasingly being implemented with PDAs to permit a user to activate software modules in the form of routines and subroutines therein.

Attempts have been made to provide venue-based, interactive entertainment to enhance the fan experience at live events. Such attempts utilize touch-screen technology integrated directly into seats at outdoor or indoor arenas. Such devices, however, due to their integration with the viewer seat, can be easily damaged by audience members. Systems that incorporate such devices are also expensive because they literally require miles of cable.

Some recently constructed arenas, for example, that implement such seat-integrated technology are requiring hundreds of miles of electronic cabling, including audiovisual, broadcast, and multiband lines. Such a plethora of large cables are expensive and require extra space, which often cannot be found in older stadiums, or would require a greater expense to integrate into newly built stadiums. The cost of retrofitting an older stadium with such technology can be staggering. Additionally, many fans who attend games or concerts with such technology integrated directly into the seats may find such a feature distracting.

Another problem faced by venue promoters and arena owners who integrate fixed technology directly into the seat is that such technology can quickly become obsolete. If a new facility is fitted with such electronic/data intensive technology, the technology may become quickly outdated, requiring an expensive update and/or retrofit.

The present inventors thus realize that a solution to these problems lies in the use of wireless hand held devices. By utilizing modern technology integrated with hand held devices, on-demand live action, instant replays from multiple camera angles, and real-time team and venue information may be readily provided to fans without the expense and problems associated with present in-seat integrated technical environments. Additionally, it is anticipated that the deployment of venue-based systems facilitating the use of such devices would be relatively inexpensive, at least in comparison to seat integrated systems. Finally, such systems will provide

the venue attendee with increased mobility and freedom of use within and throughout the venue environment.

SUMMARY OF THE INVENTION

One aspect of the present invention provides improved methods and systems for delivering venue-related data to a hand held device.

It is another aspect of the present invention to provide improved methods and systems for delivering real time video provided at an entertainment venue to a hand held device.

It is still another aspect of the present invention to provide methods and systems for providing multiple perspectives from a venue activity for viewing through a hand held device.

It is yet another aspect of the present invention to provide hand held devices and associated methods that provide on-demand video action and instant replays from multiple camera angles focused on an entertainment venue activity.

It is still another aspect of the present invention to provide hand held devices and associated methods that provide on-demand video action and instant replays from one or more wide-angle and/or panoramic cameras focused on a venue activity.

The above and other aspects of the invention are achieved as will now be further described. Methods and systems for receiving and displaying venue-based data at a hand held device are disclosed herein. According to one method described herein, data transmitted from at

least one venue-based data source may be received at a hand held device. Such data can be processed for display on a display screen associated with the hand held device. The processed data may be then displayed on the display screen, thereby enabling a user of the hand held device to view venue-based data through the hand held device.

The venue-based data source may be configured as a video camera or a group of video cameras that capture video images of a venue-activity. The video cameras may adapted to provide high-resolution wide-angle video data. Data transmitted from the venue-based data source may be received at the hand held device through at least one receiver. As described herein, frequency tuners may be associated with each video camera to enable a user to receive data transmitted over a particular frequency via a transmitter linked with the video camera.

Data may be broadcast to one or more hand held devices in a venue through wireless communications. Additionally, data may be transmitted from at least one venue-based data source to the hand held devices through a wireless network. Such data may additionally be transferred through a wireless gateway associated with the wireless network. The processed data may be displayed on a display screen, in response to user input through a user interface associated with the hand held device.

The processed data may comprise at least one perspective of a venue-based activity. A particular perspective of the venue-based activity may be displayed on the display screen, in response to a user selection of

the particular perspective of the venue activity. The data may be processed for display on the display screen associated with the hand held device utilizing at least on image-processing module, routine, subroutine, or combination thereof.

According to another method disclosed herein includes method and operational steps for wirelessly receiving venue-based data at a hand held device. In such a method, data transmitted from at least one venue-based data source may be wirelessly received at a hand held device. The data is then processed for display on a display screen associated with the hand held device. The processed data is then displayed on the display screen, thereby enabling a user of the hand held device to view venue-based data through the hand held device utilizing wireless communication techniques.

An additional method disclosed herein includes method and operational steps for receiving at least one perspective of a venue-based activity at a hand held device. In such a method, at least one perspective of a venue-based activity transmitted from at least one venue-based data source is received at a hand held device. The perspective or perspectives are processed for display on a display screen associated with the hand held device. Thereafter, at least one perspective is displayed on the display screen, thereby enabling a user of the hand held device to view venue-based perspectives through the hand held device.

An additional method is disclosed herein for displaying a particular perspective of a venue-based

activity at a hand held device. In such a method, a plurality of perspectives of a venue-based activity transmitted from at least one venue-based data source is received at a hand held device. The perspectives are processed for display on a display screen associated with the hand held device. Finally, a particular perspective may be displayed on the display screen, in response to a user selection of the particular perspective from among one or more perspectives, thereby enabling a user of the hand held device to view particular venue-based data through the hand held device.

Systems are also described herein for receiving venue-based data at a hand held device. In one such system, at least one receiver for receiving at a hand held device, data transmitted from at least one venue-based data source, is presented. Additionally, such a system may include a processor for processing the data for display on a display screen associated with the hand held device. The system can also incorporate a display screen for displaying processed data, thereby enabling a user of the hand held device to view venue-based data through the hand held device.

A wireless hand held device having at least one integrated receiver may be in the form of a held held portable television adapted to receive at least one broadcasted signal from at least one venue-based transmitter associated with at least one venue-based data source (e.g., video camera) associated with venue activity.

The venue-based data source may be configured as a

video camera. Such a video camera may be adapted to provide high-resolution wide-angle video data. The video camera can be configured as a wireless video camera. Such a system further includes one or more transmitters for broadcasting data from at least one venue-based data source to one or more hand held devices within the venue. A wireless gateway may also be integrated with such a system for transferring the data through a wireless network.

The processed data is generally displayable on the display screen, in response to user input through a user interface associated with the hand held device. The processed day may also comprise at least one perspective of a venue-based activity. A display routine may also be utilized for displaying a particular perspective of the venue-based activity on the display screen, in response to a user selection of the particular perspective of the venue activity. Additionally, a processor for processing the data for display on the display screen associated with the hand held device utilizing at least one image-processing module may also be utilized in accordance with systems of the present invention. The venue-based data may be composed of real-time video data, instant replay video data, promotional information, advertising information, and so forth.

A system for wirelessly receiving venue-based data at a hand held device is also disclosed herein. Such a system generally includes a receiver for wirelessly receiving at a wireless hand held device data transmitted from at least one venue-based data source, a processor for processing the data for display at the hand held

device, and a display screen for displaying processed data, wherein the display screen is associated with the hand held device, thereby enabling a user of the hand held device to view venue-based data through a wireless hand held device.

A system for receiving at least one perspective of a venue-based activity at a hand held device is additionally disclosed herein. Such a system includes at least one receiver for receiving at a hand held device at least one perspective of a venue-based activity transmitted from at least one venue-based data source. Such a system also incorporates a processor for processing one or more perspectives of the venue-based activity for display on a display screen associated with the hand held device. Additionally, such a system can be configured with a display screen for displaying at least one perspective view, thereby enabling a user of the hand held device to view perspectives of venue-based activity through the hand held device. The display screen may be integrated with the hand held device.

Another system disclosed herein describes a system for displaying a particular perspective of a venue-based activity at a hand held device. In such a system, at least one receiver for receiving at a hand held device, one or more perspectives of a venue-based activity transmitted from venue-based data sources, may be present. Additionally, such a system can include a processor for processing perspectives of the venue activity for display on a display screen associated with the hand held device. Such a system can also be configured with a display screen for displaying a

particular perspective on the display screen, in response to a user selection of the particular perspective from among a group of venue-activity perspectives, thereby enabling a user of the hand held device to view particular venue-based video images through the hand held device.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of this invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objects, and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

FIG. 1 depicts a block diagram illustrating components of a hand held device, in which preferred embodiments of the present invention may be implemented;

FIG. 2 illustrates a pictorial representation of a hand held device, which may be utilized to implement preferred embodiments of the present invention;

FIG. 3 depicts a pictorial representation of a hand held device adapted for receiving a module, in accordance with preferred embodiments of the present invention;

FIG. 4 illustrates a system for providing multiple perspectives through a hand held device of activities at a venue, in accordance with preferred embodiments of the present invention;

FIG. 5 depicts a system that provides multiple perspectives of a venue activity through a hand held device adapted to receive and process real time video data, in accordance with preferred embodiments of the

present invention;

FIG. 6 depicts a system for providing multiple perspectives of activity at a venue through a hand held device adapted to receive and process real time video data, in accordance with preferred embodiments of the present invention;

FIG. 7 depicts a system for providing multiple perspectives for activity at a venue at a first time/perspective and a second time/perspective, in accordance with preferred embodiments of the present invention;

FIG. 8 illustrates a system for providing multiple perspectives through a hand held device of an activity at a venue, including the use of a wireless gateway, in accordance with a preferred embodiment of the present invention;

FIG. 9 depicts a system for providing multiple perspectives through a hand held device of a venue activity, in association with a wireless network, in accordance with preferred embodiments of the present invention;

FIG 10 illustrates a diagram depicting network attributes of a wireless network that may be utilized in accordance with preferred embodiments of the present invention;

FIG. 11 depicts a prior art overview display and a detail window;

FIG. 12 illustrates a prior art spherical image space divided into a series of w rows and q columns, with the rows and columns representing individual frames as photographed from a video camera;

FIG. 13 depicts the two-dimensional representation of the spherical image space of **FIG. 12** into rows and columns of image frames;

FIG. 14 illustrates a prior art overview display, a detail window and a corresponding area indicia (geometric figure outline;

FIG. 15 depicts a prior art series of saved geometric figure outlines corresponding to user selections in tracing through an overview image display for subsequent playback, which may be utilized in accordance with embodiments of the present invention;

FIG. 16 is a prior art flowchart providing a logical process for building an overview image, which may be utilized in accordance with embodiments of the present invention;

FIG. 17 illustrates a prior art flowchart illustrative of a logical process for playback interaction, which may be utilized in accordance with embodiments of the present invention;

FIG. 18 depicts a pictorial representation illustrative of a Venue Positioning System (VPS) in

accordance with preferred embodiments of the present invention;

FIG. 19 illustrates in greater detail the Venue Positioning System (VPS) of FIG. 18, in accordance with preferred embodiments of the present invention;

FIG. 20 depicts a flowchart of operations illustrative of a method for providing multiple venue activities through a hand held device, in accordance with preferred embodiments of the present invention; and

FIG. 21 illustrates a flowchart of operations illustrative of a method for providing multiple venue activities through a hand held device from one or more digital video cameras, in accordance with preferred embodiments of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

FIG. 1 depicts a schematic diagram illustrating a general hardware configuration of a hand held device **11**, in accordance with an embodiment of the present invention. Those skilled in the art can appreciate, however, that other hardware configurations with less or more hardware and/or modules may be utilized in carrying out the methods and systems (e.g., hand held device **11**) of the present invention, as may be further described herein. CPU **10** of hand held device **11**, performs as a main controller operating under the control of operating clocks supplied from a clock oscillator. CPU 10 may be configured as a 16-bit microprocessor. External pins of CPU **10** are generally coupled to an internal bus **26** so that it may be interconnected to respective components.

SRAM **24** can be configured as a writeable memory that does not require a refresh operation and can be generally utilized as a working area of CPU **10**. SRAM (Static RAM) is generally a form of semiconductor memory (RAM) based on a logic circuit known as a flip-flop, which retains information as long as there is enough power to run the device. Font ROM **22** can be configured as a read only memory for storing character images (e.g., font) displayable on a display **18**. Examples of types of displays that may be utilized in accordance with display **18** include a TFT active matrix display, an illuminated LCD (Liquid Crystal Display), or other small scale displays being developed.

CPU **10** of the present embodiment drives display **18** utilizing, among other media, font images from Font ROM **22**, and images transmitted as data through wireless unit **17** and processed by image-processing unit **35**. EPROM **20** may be configured as a read only memory that is generally erasable under certain conditions and can be utilized for permanently storing control codes for operating respective hardware components and security data, such as a serial number.

IR controller **14** can be generally configured as a dedicated controller for processing infrared codes transmitted/received by an IR transceiver **16** and for capturing the same as computer data. Wireless unit **17** can be generally configured as a dedicated controller and transceiver for processing wireless data transmitted from and to a wireless communications network.

Port **12** can be connected to CPU **10** and can be temporarily attached, for example, to a docking station to transmit information to and from hand held device **11** to other devices, such as personal computers, retail cash registers, electronic kiosk devices, and so forth. Port **12** can also be configured, for example, to link with a modem, cradle or docking station, which are well known in the art, that permit network devices, a personal computer or other computing devices to communicate with hand held device **11**.

User controls **32** permit a user to enter data to hand held device **11** and initiate particular processing operations via CPU **10**. A user interface **33** may be

linked to user controls **32** to permit a user to access and manipulate hand held device **11** for a particular purpose, such as, for example, viewing images on display **18**. Those skilled in the art will appreciate that user interface **33** may be implemented as a touch screen user interface, as indicated by the dashed lines linking display **18** with user interface **33**. In addition, CPU **10** may cause a sound generator **28** to generate sounds of predetermined frequencies from a speaker **30**. Speaker **30** may be utilized to produce music and other audio information associated with video data transmitted to hand held device **11** form an outside source.

Those skilled in the art can appreciate that additional electronic circuits or the like other than, or in addition to, those illustrated in **FIG. 1** may be required to construct hand held device **11**. Such components, however, are not described in the present specification, because many aspect of them are well known in the art. For example, hand held television are available for receiving public television broadcasts, but the basic technology can be modified on such devices so that they may be adapted to (e.g., proper authentication, filters, security codes, or the like) receive venue-based RF transmissions from at least one venue-based RF source (e.g., a wireless camera, or data from a camera transmitted wirelessly through a transmitter). Those skilled in the art can thus appreciate that because of the brevity of the drawings described herein, only a portion of the connections between the illustrated hardware blocks is generally depicted. In addition, those skilled in the art will

appreciate that hand held device **11** can be implemented as a specific type of a hand held device, such as a Personal Digital Assistant (PDA), paging device, WAP-enabled mobile phone, and other associated hand held computing devices well known in the art.

Hand held device **11** can be configured to permit images, such as television broadcast images, to be displayed on display **18** for a user to view. Hand held device **35** thus includes an image-processing unit **35** for processing images transmitted as data to hand held device **11** through wireless unit **17**. A tuner unit **34**, implemented as either a single tuner or a plurality of tuners, may be linked through internal bus **26** to CPU **10**. Additionally, a security unit **36** may be utilized to process proper security codes to thereby ensure that data transferred to and from hand held device **11** may be secure and/or permitted. Security unit **36** may be implemented as an optional feature of hand held device **11**. Security unit **36** can also be configured with routines or subroutines that are processed by CPU **10**, and which prevent wireless data from being transmitted/received from hand held device **11** beyond a particular frequency range, outside of a particular geographical area associated with a local wireless network, or absent authorized authorization codes (e.g., decryption).

Hand held device **11** can thus be configured with both wireless and wireline capabilities, depending on the needs and requirements of a manufacturer or customer. Such wireless capabilities include features

such as those found in cellular telephone units, in accordance with carrying out embodiments of the present invention. Examples of hand held devices that can be utilized in accordance with the method and system of the present invention include the "PalmPilot" PDA, manufactured and sold by Palm Computing, the Handspring Visor, the IBM Workpad or other Window CE compatible devices, RIM Blackberry-family paging devices, Motorola paging devices, and the Symbol SPT-family of PDA-type organizer devices. Customized, venue-specific devices (i.e., proprietary, limited use) may be also developed that incorporate hardware and software modules necessary to practice the methods and systems taught herein.

Those skilled in the art can appreciate that although hand held device **11** is generally illustrated in **FIG. 1**, hand held device **11** can be implemented as a wireless application protocol (WAP) web-enabled cellular hand held device, such as a PDA, wireless telephone, or pager or a combination thereof. Hand held device **11** can configured with features of combination cellular telephone/PDA devices. One example of such a device is the Handspring™ palmtop and associated cellular phone attachment, which is manufactured and sold by Handspring Inc. Other such devices include the Palm-Motorola phone, which permits users to access e-mail and store calendars and contact databases. Hand held devices may be also provided in the form of a multi-RF (Radio Frequency) receiver-enabled hand held television viewing device. Regardless of the type of hand held device implemented, it is anticipated that such hand held devices will be adapted to receive and process data via

image-processing unit **35** for ultimate display as moving images on display unit **18**, in accordance with the present invention. Image-processing unit **35** may include image-processing routines, subroutines, software modules, and so forth, which perform image-processing operations.

FIG. 2 illustrates a pictorial representation of a hand held device **40**, which may be utilized to implement preferred embodiments of the present invention. Those skilled in the art will appreciate that hand held device **40** of **FIG. 2** is analogous to hand held device **11** of **FIG. 1**. Hand held device **40** includes a display screen **42**, which is generally analogous to display **18** of **FIG. 1**. Television images broadcast via radio frequency or digital data may be displayed on display screen **42** for a user to view. User controls **44** permit a user to manipulate images or text displayed on display screen **42**. User controls **44** of **FIG. 2** are generally analogous to user controls **32** of **FIG. 1**. A touch screen user interface may be further configured on the display screen **42** with hand held device **40** to permit a user to manipulate images/text displayed on display screen **42**.

FIG. 3 depicts a pictorial representation of a hand held device **56** adapted for receiving a module **50**, in accordance with preferred embodiments of the present invention. Hand held device **56** of **FIG. 3** is generally analogous to hand held device **40** of **FIG. 2**, the difference being that hand held device **56** may be adapted to receive a module/cartridge that permits hand held device **56** to function according to specific hardware

and/or instructions contained in a memory location within module **50**. Module **50** may also be configured as a smart card, well known in the art. Such a smart card may provide, for example, access codes (e.g., decryption) to enable hand held device **56** to receive venue broadcasts. Note that as utilized herein, the term "module" may refer to a physical module, such as a cartridge. The term "module" may also refer to a software module composed of routines or subroutines that perform a particular function. Those skilled in the art can appreciate the meaning of the term module is based on the context in which the term is utilized. Thus, module **50** may be generally configured as a physical cartridge or smart card. The term "module" as utilized herein may also refer to a software module, depending on the context of the discussion thereof.

To illustrate the use of a physical module, such as module **50**, assume that a user may possess several such physical modules or cartridges. One module, when inserted into hand held device **FIG. 3** may instruct hand held device **50** to function as a standard PDA, such as a Palm Pilot device. Another module, when inserted into hand held device **FIG. 3**, may instruct hand held device **56** to function as a portable television that receives wireless television data from a local wireless network and/or venue-based (short range) broadcasts.

Those skilled in the art can thus appreciate that hand held device **56** can be adapted to receive and cooperate with module **50**. Additionally, hand held device **56** includes a display screen **52** that is generally

analogous to display screen **42** of **FIG. 2** and display **18** of **FIG. 1**. Hand held device **56** also includes user controls **54** that are generally analogous to user controls **44** of **FIG. 2** and user controls **32** of **FIG. 1**. Hand held device **56** of **FIG. 3** is generally analogous to hand held device **11** of **FIG. 1**. Thus, hand held device **56** can also implement touch screen capabilities through a touch screen user interface integrated with display screen **52**.

Assuming module **50** is implemented as a smart card, instead of a cartridge, it is anticipated that similar features can be implemented in accordance wit the smart card to insure that hand held device **56** includes touch screen user interface and video viewing capabilities. Smart cards are generally known in the art as credit-card sized plastic cards with an embedded computer chip. The chip can either be a microprocessor with internal memory or a memory chip with non-programmable logic. The chip connection can be configured via direct physical contact or remotely through a contactless electromagnetic interface.

Smart cards may be generally configured as either a contact or contactless smart card, or a combination thereof. A contact smart card requires insertion into a smart card reader (e.g., contained within hand held device 56) with a direct connection to, for example, a conductive micromodule on the surface of the card. Such a micromodule may be generally gold plated. Transmission of commands, data, and card status takes place through such physical contact points.

A contactless card requires only close proximity to a reader. Both the reader and the card may be implemented with antenna means providing a contactless link that permits the devices to communicate with one another. Contactless cards can also maintain internal chip power or an electromagnetic signal (e.g., RF tagging technology). Two additional categories of smart codes, well known in the art, which are based on contact and contactless cards are the so-called *Combi* cards and *Hybrid* cards.

A *Hybrid* card generally may be equipped with two chips, each with a respective contact and contactless interface. The two chips are not connected, but for many applications, this Hybrid serves the needs of consumers and card issuers. The *Combi* card may be generally based on a single chip and can be generally configured with both a contact and contactless interface.

Chips utilized in such smart cards are generally based on microprocessor chips or memory chips. Smart cards based on memory chips depend on the security of the card reader for their processing and can be utilized when low to medium security requirements. A microprocessor chip can add, delete and otherwise manipulate information in its memory. Microprocessor-based memory cards typically contain microprocessor chips with 8, 16, and 32 bit architectures.

FIG. 4 illustrates a system **58** for providing multiple perspectives through a hand held device **60** of activities at a venue **80**, in accordance with preferred

embodiments of the present invention. For illustrative purposes only, it may be assumed that venue **80** of **FIG. 4** is a stadium venue, such as a football stadium. Cameras **71**, **73**, **75**, and **77** are respectively positioned at strategic points about venue **80** to capture the best images of activity taking place within venue **80**. Cameras **71**, **73**, **75**, **77** are respectively linked to transmitters **70**, **72**, **74**, and **76**. Each of these transmitters may be configured as equipment, which feeds a radio signal to an antenna for transmission.

The antenna may be integrated with the transmitter. Transmitters are well known in the art, and include active components, such as a driver, well known in the art. Transmitters also include passive components, such as a TX filter, also well known in the art. These components, when operating together, impress a signal onto a radio frequency carrier of the correct frequency by immediately adjusting its frequency, phase, or amplitude, thereby providing enough gain to the signal to project it to its intended target (e.g., a hand held device located within the venue).

A hand held device **60** may be held by a user at a stadium seat within view of the activity at the venue **80**. Hand held device **60** is generally analogous to hand held device **11** of **FIG. 1** and hand held device **40** of **FIG. 2**. Hand held device **60** of **FIG. 4** may be configured as a hand held device adapted for use with a cartridge/module, such as module **50** of hand held device **56** of **FIG. 3**. The cartridge/module may contain the electronics (e.g., tuner, filter, etc.) to allow a hand

held device to be adapted for receiving venue-based data. Hand held device **60** includes a display screen **61** (e.g. display **18** of **FIG. 1**).

Additionally, display screen **61** of hand held device **60** may be configured with a touch screen user interface displayable and operable on display screen **61**. Those skilled in the art can appreciate that touch screen interfaces are well known in the art and further explanation thereof may be not necessary. Display screen **61** includes a touch screen display area **65** that may be associated with camera **71**. Thus, images captured by camera **71** are transmitted from transmitter **70**, which is linked to camera **71**. Additionally, display screen **61** includes touch screen display areas **69**, **63**, and **67** which are respectively associated with cameras **73**, **75**, and **77**.

Cameras **71**, **73**, **75**, and **77** are respectively labeled C_1, C_2, C_3, and C_N to indicated that a plurality of cameras may be utilized in accordance with system **58** to view activities taking place within venue **80**, such as a football game or concert. Although only four cameras are illustrated in **FIG. 4**, those skilled in the art will appreciate that additional or fewer cameras may be also implemented in accordance with system **58**. Touch screen display areas **65**, **69**, **63**, and **67** are also respectively labeled C_1, C_2, C_3, and C_N to illustrate the association between these display areas and cameras **71**, **73**, **75**, and **77**.

Hand held device **60** may be integrated with a

plurality of tuners, as illustrated by tuners **62**, **64**, **66**, and **68**. Such tuners can be activated via user controls on hand held device **60** and/or via touch screen icons or areas displayed on display screen **61** that are associated with each tuner. Such icons/areas may be respectively displayed within display areas **65**, **69**, **63** and **67**, or within a separate display area of display screen **61**. A user accesses tuner **62**, for example, to retrieve real-time video images transmitted from transmitter **70** for camera **71**. Likewise, a user can access tuner **64** to retrieve real-time video images transmitted from transmitter **72** for camera **73**.

In addition, a user can access tuner **74** to retrieve real-time video images transmitted from transmitter **74** for camera **75**. Finally, user can access tuner **68** to retrieve real-time video images transmitted from transmitter **76** for camera **77**. In the example depicted in **FIG. 4**, a football player **82** is participating in a football game within venue **80**. Cameras **71**, **73**, **75**, and **77** capture moving images (e.g., video data) of the football player **82** from various angles and transmit these images to hand held device **60**.

FIG. 5 depicts a system **59** that provides multiple perspectives of activity at a venue **80** through a hand held device **60** adapted to receive and process real time video data, in accordance with preferred embodiments of the present invention. Note that in **FIG. 4** and **FIG. 5** analogous parts are indicated by identical reference numerals. Thus, for example, cameras **71**, **73**, **75**, and **77** of **FIG. 5** are analogous to cameras **71**, **73**, **75**, and **77** of

FIG. 4. Hand held device **60** of **FIG. 5** is also analogous to hand held device **60** of **FIG. 4** and includes similar features thereof.

Hand held device **60** of **FIG. 5**, however, can be configured to receive wireless real time video data transmitted for cameras **71**, **73**, **75**, and **77** respectively through data transmitters **102**, **104**, **106**, and **108** to server **100** and thereafter to wireless data transmitter/receiver **110**. Note that wireless data transmitter/receiver **110** is analogous to wireless unit **17** of **FIG. 1**. Hand held device **60** of **FIG. 5** is also analogous to hand held device **11** of **FIG. 1**.

Hand held device **60** of **FIG. 5** also incorporates a touch screen user interface, as described herein with respect to analogous hand held device **60** of **FIG. 4**. The difference between system **58** of **FIG. 4** and system **59** of **FIG. 5** lies in the inclusion of digital transmitters **102**, **104**, **106**, and **108** which are respectively linked to cameras **71**, **73**, **75**, and **77** of **FIG. 5**. In the illustration of **FIG. 5**, cameras **71**, **73**, **75**, and **77** may be configured as high definition video cameras which capture real time images of events or activities taking place within venue **80**, such as real time video footage of football player **82**.

A captured image of football player **82** can be transferred from one or more of video cameras **71**, **73**, **75**, and **77** of **FIG. 5** and transmitted through a respective digital transmitter, such as digital transmitter **102**, **104**, **106** or **108** and transmitted via

wired and/or wireless communications to server **100**. The server **100** then processes the video data received from one or more of the digital transmitters and formats the video data for transmission via wireless means to wireless data transmitter/receiver **100**, which may be integrated with hand held device **100**. Transmitter/receiver **100** can communicate with the various components of hand held device **60**, such as a CPU, image-processing unit, memory units, and so forth.

Those skilled in the art can appreciate that although real time video data may be transmitted to server **100**, captured past video images may also be stored within server **100** and transferred to hand held device **60** for display at display screen **61**. For example, instant replays may be transferred as video data to hand held device **60** upon the request of a user of hand held device **60**. Such instant replay footage can be displayed on display screen **61** for the user to view.

FIG. 6 illustrates a system **79** for providing multiple perspectives of activity at a venue **80** through a hand held device **60** adapted to receive and process real time video data from at least one wide-angle and/or panoramic video camera **114**, in accordance with preferred embodiments of the present invention. In system **79** of **FIG. 6**, wide-angle/panoramic (hereinafter referred to as "panoramic") video camera **114** may be configured as a high-definition panoramic video camera that captures images of activities taking place at venue **80**. In the example illustrated in **FIG. 6**, panoramic video camera

114 can capture of images of a football game and one or more football players, such as football player **82**.

A data transmitter **112** may be linked to panoramic video camera **114**. Video data captured by panoramic video camera **114** may be transferred to data transmitter **112**, which thereafter transmits the video data to server **100** via a direct link or wireless link, depending on the needs or requirements of the promoters or venue owners. Note that this is also true of the system described in **FIG. 6**. Server **100** of **FIG. 6** is analogous to server **100** of **FIG. 5**. Thus, in the case of **FIG. 5**, video data may be transmitted from one or more of data transmitters **102, 104, 106,** and **108** via a direct wire/cable link or through wireless transmission means, such as through a wireless network.

Those skilled in the art will appreciate, of course, that hand held device **60** of **FIG. 6** is analogous to hand held devices depicted in **FIGS. 1-5** herein. In **FIGS. 4, 5,** and **6,** like or analogous parts are identified by identical reference numerals. Thus, images captured by panoramic video camera **114** of activity taking place at venue **80** may be displayed as real time video images or instant replay data on display screen **61** of hand held device **60**.

FIG. 7 depicts a system **89** for providing multiple perspectives for activity at a venue **120** at a first time and/or perspective (**Time 1**) and a second time and/or perspective (**Time 2**), in accordance with preferred embodiments of the present invention. In **FIGS. 4, 5, 6,**

and **7**, like or analogous parts are indicated by identical reference numerals. Thus, in system **89** of **FIG. 7**, an event, in this case illustrated as a hockey game, is taking place within venue **120**. Venue **120** may be, for example, a hockey arena. Panoramic video camera **114** may be linked to data transmitter **112**.

As explained previously, data transmitter **112** may be linked to server **100** via a direct link, such as a transmission cable or line, or through wireless communication means, such as through a wireless network. Server **100** can also communicate with hand held device **60** through a wireless network or other wireless communication means by transmitting data through such a network or wireless communications means to wireless data transmitter/receiver **110**. Wireless data transmitter/receiver **110**, as explained previously, may be integrated with hand held device **60**.

Thus, a video image **124** of a hockey player **122** can be captured as video data by panoramic video camera **114**, along with a video image **126** of a hockey player **123** and displayed within display screen **61** of hand held device **60** as indicated at **Time 1**. Video image **124** and **126** can be displayed within a grid-like interface on display screen **61**. Note that in the illustration of **FIG. 7**, display screen **61** may be divided into four sections.

When a user touches, for example the area or section of display screen **61** in which video image **124** may be displayed, the entire display area of display screen **61** can be then consumed with a close-up video

shot of video image **124**, as indicated at **Time 2**, thereby providing the user with a closer view of hockey player **122**. Those skilled in the art can appreciate that the touch screen display area of display screen **61** can be arranged with graphical icons and/or user-controls that perform specific pan and zoom functions. Such icons/user-controls, when activated by a user, permit the user to retrieve panned/zoomed images of events taking place in real time within venue **120**.

Note that although only one panoramic video camera **114** and one data transmitter **112** are illustrated in **FIG. 7**, a plurality of panoramic video cameras, servers, and data transmitters may be implemented in accordance with the present invention to capture the best video images, image-processing, and signal capacity to users, whether real time or otherwise, of events taking place at venue **120**.

FIG. 8 illustrates a system **92** for providing multiple perspectives through hand held device **60** of an activity at a venue **130**, including the use of a wireless gateway **124**, in accordance with a preferred embodiment of the present invention. Those skilled in the art can appreciate that wireless gateway **124** may be configured as an access point for a wireless LAN (Local Area Network). Access points for wireless LAN networks and associated wired and wireless hardware (e.g., servers, routers, gateways, etc.) are well known in the art and may be utilized in accordance with the present invention described herein. Again, note that in **FIGS. 4, 5, 6, 7,** and **8**, like or analogous parts are indicated by

identical reference numerals. System **92** of **FIG. 8** is analogous to system **89** of **FIG. 7**, the difference being in the nature of the venue activity. Venue **130** can be, for example, a concert hall or stadium configured with a sound stage.

Gateway **124** can be configured as a communications gateway through which data may enter or exit a communications network, such as wireless network **152** illustrated in **FIG. 9** for a large capacity of user hand device **60** users. Wireless network **152** may be configured as a wireless LAN network. Hand held device **60** can be configured to communicate and receive transmissions from such a wireless LAN network based on device identification (e.g., device address). Communication with hand held devices, such as hand held device **60**, however, may also be achieved through RF (Radio Frequency) broadcasts, thereby not requiring two-way communication and authentication between, for example, a wireless LAN network and such hand held devices. A broadcast under such a scenario may also require that such a hand held device or hand held devices possess decryption capabilities or the like in order to be authorized to receive transmissions from the venue.

The remaining elements of **FIG. 8** are also analogous to the elements depicted in the previous drawings, with the addition of wireless gateway **124**, which may be linked to server **100** and may be in communication with several wireless data transmitters/receivers **110** and one or more electronic hand held devices, including hand held device **60**. Wireless data transmitter/receiver **110**,

as explained previously, may be integrated with hand held device **60**. One or more panoramic video cameras, such as panoramic video camera **114**, can be positioned at a venue **130** at locations that capture images not only of the events taking place on a concert stage, but also events taking place within the stadium itself.

If an audience member **140**, for example, happens to be walking along a stadium aisle within view of panoramic video camera **114**, the audience member's video image can be displayed as video image **144** within display screen **61** of hand held device **60**, as indicated at **Time 1**. Likewise, panoramic video camera **114** captures images of band member **138** whose video image can be displayed as video image **142** within a display area of display screen **61**, as indicated at **Time 1**.

Thus, a user of hand held device **60** can view not only the events taking place on a central performing platform of venue **130**, but also other events within the arena itself. The band member **138** may be located on a central performing platform (not shown) of venue **130** when panoramic video camera **114** captures real-time video images of band member **138**. The user may also, for example, wish to see a close-up of audience member **140**. By activating user controls and/or a touch screen interface integrated with display screen **61**, the user can, for example, pan or zoom to view a close-up video shot of audience member **140**, as indicated at **Time 2**.

Captured video images are transferred from panoramic video camera **114** as video data through

transmitter **112** to server **100** and through wireless gateway **124** to wireless data transmitter/receiver **110**. Although a single server **100** is illustrated in **FIG. 8**, those skilled in the art can appreciate that a plurality of servers may be implemented in accordance with the present invention to process captured and transmitted video data. Based on the foregoing, those skilled in the art can appreciate that video data may be simultaneously transferred from server **100** or a plurality or servers to literally thousands of hand held devices located within the range of the wireless network and/or wireless gateways associated with venue **130**.

FIG. 9 illustrates a system **150** for providing multiple perspectives through hand held device **60** of an activity at a venue **130** in association with a wireless network **152**, in accordance with preferred embodiments of the present invention. System **150** of **FIG. 9** is analogous to system **92** of **FIG. 8**, the difference noted in the inclusion of wireless network **152**. Thus, in **FIG. 8** and **FIG. 9**, like or analogous parts are indicated by identical reference numerals. Video data captured by a camera or cameras, such as panoramic video camera **114**, may be transferred to data transmitter **112**, which transmits the video data to wireless network **152**. Wireless network **152** then retransmits the data, at the request of authorized users of hand held devices, such as hand held device **60**, to wireless data transmitters/receivers, such as transmitter/receiver **110** integrated with hand held device **60**.

Those skilled in the art can appreciate that

wireless network **152** may also receive and retransmit other data, in addition to video data. For example, a server or other computer system may be integrated with wireless network **152** to provide team and venue data, which can then be transferred to wireless data transmitter receiver **110** from wireless network **152** and displayed thereafter as team and venue information within display screen **61** of hand held device **60**. Other data that may be transferred to hand held device for display include real-time and historical statistics, purchasing, merchandise and concession information, and additional product or service advertisements.

Such data can include box scores, player matchups, animated playbooks, shot/hit/pitch charts, historical information, and offense-defense statistics. In a concert venue, for example, as opposed to a sporting event, information pertaining to a particular musical group can be also transferred to the hand held device, along with advertising or sponsor information. Note that both the video data and other data described above generally comprise types of venue-based data. Venue-based data, as referred to herein, may include data and information, such as video, audio, advertisements, promotional information, propaganda, historical information, statistics, event scheduling, and so forth, associated with a particular venue and generally not retrievable through public networks.

Such information can be transmitted together with video data received from data transmitter **112**. Such information may be displayed as streaming data within

display area **61** of hand held device **60** or simply stored in a database within hand held device **60** for later retrieval by the user. An example of a wireless network that may be utilized to implement wireless network **152** can be *Bluetooth*, which is described in greater detail herein, and was conceived originally to make up for the shortcomings of infrared technologies (IR). Because IR cannot be utilized to penetrate walls, carry data heavy signals, or operate within devices that are not in line of sight, *Bluetooth*, which is becoming well-known the art, can be configured as or with wireless network **152**.

FIG 10 illustrates an entity diagram **170** depicting network attributes of wireless network **152** that may be utilized in accordance with preferred embodiments of the present invention. Wireless network **152** of **FIG. 10** is analogous to wireless network **152** of **FIG. 9**. Wireless network **152** as illustrated in **FIG. 10** can be configured as a variety of possible wireless networks. Thus, entity diagram **170** illustrates attributes of wireless network **152**, which may or may not be exclusive of one another.

Those skilled in the art can appreciate that a variety of possible wireless communications and networking configurations may be utilized to implement wireless network **152**. Wireless network **152** may be, for example, implemented according to a variety of wireless protocols, including cellular, *Bluetooth*, and RF or direct IR communications. Wireless network **152** can be implemented as a single network type (e.g., *Bluetooth*) or a network based on a combination of network types

(e.g., GSM, CDMA, etc).

Wireless network **152** may be configured with teachings/aspects of CDPD (Cellular Digital Packet Data) networks well known in the networking arts. CDPD network **154** is illustrated in **FIG. 10**. CDPD may be configured as a TCP/IP based technology that supports Point-to-Point (PPP) or Serial Line Internet Protocol (SLIP) wireless connections to mobile devices, such as the hand held devices described and illustrated herein. Cellular service is generally available throughout the world from major service providers. Data can be transferred utilizing CDPD protocols.

Current restrictions of CDPD are not meant to limit the range or implementation of the method and system described herein, but are described herein for illustrative purposes only. It is anticipated that CDPD will be continually developed, and that such new developments can be implemented in accordance with the present invention.

Wireless network **152** may preferably be also configured with teachings/aspects of a Personal Area Network **156** or *Bluetooth*, as described herein. *Bluetooth* was adopted by a consortium of wireless equipment manufacturers referred to at the Bluetooth Special Interest Group (BSIG), and has emerged as a global standard for low cost wireless data and voice communication. Current specifications for this standard call for a 2.4 GHz ISM frequency band. *Bluetooth* technology is generally based on a short-range radio

transmitter/receiver built into small application specific circuits (ASICS, DSPs) and embedded into support devices, such as the hand held devices described and illustrated herein.

The *Bluetooth* standard permits up to 100 mw of power, which can increase the range to 100 M. In addition, *Bluetooth* can support several data channels. Utilizing short data packets and frequency hopping of up to 1600 hops per second, *Bluetooth* is a wireless technology that can be utilized to enable the implementation of the methods and systems described herein. Current restrictions of *Bluetooth* are not meant to limit the range or implementation of the present invention, but are described herein for illustrative purposes only. It is anticipated *Bluetooth* will be continually developed, and that such new developments can be implemented in accordance with the present invention.

Wireless network **152** may also be configured utilizing teachings/aspects of GSM network **158**. GSM (Global System for Mobile Communication) and PCS (Personal Communications Systems) networks, both well known in the telecommunications arts, generally operate in the 800 MHz, 900 MHz, and 1900 MHz range. PCS initiates narrowband digital communications in the 900 MHz range for paging, and broadband digital communications in the 1900 MHz band for cellular telephone service. In the United States, PCS 1900 is generally equivalent to GSM 1900. GSM operates in the 900 MHz, 1800-1900 MHz frequency bands, while GSM 1800 is widely utilized throughout Europe and many other

parts of the world.

In the United States, GSM 1900 is generally equivalent to PCS 1900, thereby enabling the compatibility of these two types of networks. Current restrictions of GSM and PCS are not meant to limit the range or implementation of the present invention, but are described herein for illustrative purposes only. It is anticipated that GSM and PCS will be continually developed, and that aspects of such new developments can be implemented in accordance with the present invention.

Wireless network **152** may also utilize teachings/aspects of GPRS network **160**. GPRS technology, well-known in the telecommunications arts, bridges the gap between current wireless technologies and the so-called "next generation" of wireless technologies referred to frequently as the third-generation or 3G wireless technologies. GPRS is generally implemented as a packet-data transmission network that can provide data transfer rates up to 115Kbps. GPRS can be implemented with CDMA and TDMA technology and supports X.25 and IP communications protocols, all well known in the telecommunications arts. GPRS also enables features, such as Voice over IP (VoIP) and multimedia services. Current restrictions of GPRS are not meant to limit the range or implementation of the present invention, but are described herein for illustrative purposes only. It is anticipated that GPRS will be continually developed and that such new developments can be implemented in accordance with the present invention.

Wireless network **152** may also be implemented utilizing teaching/aspects of a CDMA network **162** or CDMA networks. CDMA (Code Division Multiple Access) is a protocol standard based on IS-95 CDMA, also referred to frequently in the telecommunications arts as CDMA-1. IS-95 CDMA is generally configured as a digital wireless network that defines how a single channel can be segmented into multiple channels utilizing a pseudo-random signal (or code) to identify information associated with each user. Because CDMA networks spread each call over more than 4.4 trillion channels across the entire frequency band, it is much more immune to interference than most other wireless networks and generally can support more users per channel.

Currently, CDMA can support data at speeds up to 14.4 Kbps. Wireless network **152** may also be configured with a form of CDMA technology known as wideband CDMA (W-CDMA). Wideband CDMA may be also referred to as CDMA 2000 in North America. W-CDMA can be utilized to increase transfer rates utilizing multiple 1.25 MHz cellular channels. Current restrictions of CDMA and W-CDMA are not meant to limit the range or implementation of the present invention, but are described herein for illustrative purposes only. It is anticipated that CDMA and W-CDMA will be continually developed and that such new developments can be implemented in accordance with the present invention.

Wireless network **152** may be also implemented utilizing teachings/aspects of paging network **164**. Such paging networks, well known in the telecommunications

arts, can be implemented in accordance with the present invention to enable transmission or receipt of data over the TME/X protocol, also well known in the telecommunications arts. Such a protocol enables notification in messaging and two-way data coverage utilizing satellite technology and a network of base stations geographically located throughout a particular geographical region. Paging network **162** can be configured to process enhanced 2-way messaging applications.

Unified messaging solutions can be utilized in accordance with wireless network **152** to permit carriers and Internet service providers to manage customer e-mail, voice messages and fax images and can facilitate delivery of these communications to PDAs, telephony devices, pagers, personal computers and other capable information retrieval devices, wired or wireless.

Current restrictions of such paging networks are not meant to limit the range or implementation of the present invention, but are described herein for illustrative purposes only. It is anticipated that such paging networks, including those based on the TME/X protocol, will be continually developed and that such new developments can be implemented in accordance with the present invention.

Wireless network **152** may also be configured utilizing teachings/aspects of TDMA networks **166**. TDMA (Time Division Multiple Access) is a telecommunications network utilized to separate multiple conversation

transmissions over a finite frequency allocation of through-the-air bandwidth. TDMA can be utilized in accordance with the present invention to allocate a discrete amount of frequency bandwidth to each user in a TDMA network to permit many simultaneous conversations or transmission of data. Each user may be assigned a specific timeslot for transmission. A digital cellular communications system that utilizes TDMA typically assigns 10 timeslots for each frequency channel.

A hand held device operating in association with a TDMA network sends bursts or packets of information during each timeslot. Such packets of information are then reassembled by the receiving equipment into the original voice or data/information components. Current restrictions of such TDMA networks are not meant to limit the range or implementation of the present invention, but are described herein for illustrative purposes only. It is anticipated that TDMA networks will be continually developed and that such new developments can be implemented in accordance with the present invention.

Wireless network **152** may also be configured utilizing teachings/aspects of Wireless Intelligent Networks (WINs) **168**. WINs are generally known as the architecture of the wireless switched network that allows carriers to provide enhanced and customized services for mobile telephones. Intelligent wireless networks generally include the use of mobile switching centers (MSCs) having access to network servers and databases such as Home Location Registers (HLRs) and Visiting Location Registers (VLRs), for providing

applications and data to networks, service providers and service subscribers (wireless device users).

Local number portability allows wireless subscribers to make and receive calls anywhere - regardless of their local calling area. Roaming subscribers are also able to receive more services, such as call waiting, three-way calling and call forwarding. A HLR is generally a database that contains semipermanent mobile subscriber (wireless device user) information for wireless carriers' entire subscriber base.

A useful aspect of WINs for the present invention is enabling the maintenance and use of customer profiles within an HLR/VLR-type database. Profile information may be utilized for example with season ticket holders and/or fans of traveling teams or shows. HLR subscriber information as used in WINs includes identity, service subscription information, location information (the identity of the currently serving VLR to enable routing of communications), service restrictions and supplementary services/information. HLRs handle SS7 transactions in cooperation with Mobile Switching Centers and VLR nodes, which request information from the HLR or update the information contained within the HLR. The HLR also initiates transactions with VLRs to complete incoming calls and update subscriber data. Traditional wireless network design is generally based on the utilization of a single HLR for each wireless network, but growth considerations are prompting carriers to consider multiple HLR topologies.

The VLR may be also configured as a database that contains temporary information concerning the mobile subscribers currently located in a given MSC serving area, but whose HLR may be elsewhere. When a mobile subscriber roams away from the HLR location into a remote location, SS7 messages are used to obtain information about the subscriber from the HLR, and to create a temporary record for the subscriber in the VLR.

Signaling System No. 7 (referred to as SS7 or C7) is a global standard for telecommunications. In the past the SS7 standard has defined the procedures and protocol by which network elements in the public switched telephone network (PSTN) exchange information over a digital signaling network to effect wireless and wireline call setup, routing, control, services, enhanced features and secure communications. Such systems and standards may be utilized to implement wireless network **152** in support of venue customers, in accordance with the present invention.

Improved operating systems and protocols allow Graphical User Interfaces (GUIs) to provide an environment that displays user options (e.g., graphical symbols, icons or photographs) on a wireless device's screen. Extensible Markup Language ("XML") is generally a currently available standard that performs as a universal language for data, making documents more interchangeable. XML allows information to be used in a variety of formats for different devices, including PCs, PDAs and web-enabled mobile phones.

XML enables documents to be exchanged even where

the documents were created and/or are generally used by different software applications. XML may effectively enable one system to translate what another systems sends. As a result of data transfer improvements, wireless device GUIs can be utilized in accordance with a hand held device and wireless network **152**, whether configured as a paging network or another network type, to render images on the hand held device that closely represent the imaging capabilities available on desktop computing devices.

Those skilled in the art can appreciate that the system and logical processes described herein relative to **FIGS. 11** to **FIG. 17** are not limiting features of the present invention. Rather, **FIGS. 11** to **FIG. 17** provide examples of image-processing systems and logical processes that can be utilized in accordance with the present invention. Such a system and logical processes represent one possible technique, which may be utilized in accordance with one or more embodiments of the present invention to permit a user of a hand held device to manipulate video images viewable on a display screen of the hand held device.

FIG. 11 thus illustrates a prior art overview display **200** and a detail window **210** that may be utilized with embodiments of the present invention. The overview image display **200** is a view representative of a 360° rotation around a particular point in a space. While a complete rotational view may be utilized in accordance with preferred embodiments of the present invention, one of ordinary skill in the computer arts will readily

comprehend that a semi-circular pan (such as used with wide-angle cameras) or other sequence of images could be substituted for the 360 degree rotation without departing from the subject invention. The vantage point is generally where the camera was located as it panned the space. Usually the scene is captured in a spherical fashion as the camera pans around the space in a series of rows as depicted in **FIG. 12**. The space is divided into w rows **220-224** and q columns **230-242** with each q representing another single frame as shown in **FIG. 12**.

User control over the scene (e.g., rotation, pan, zoom) may be provided by pressing a touch screen display icon or moving a cursor displayed on a display screen of a hand held device, such as the hand held devices described herein. User control over the scene may also be provided by manipulating external user controls integrated with a hand held device (e.g., user controls **44** and **54** of **FIG. 2** and **FIG. 3**). Movement from a frame in the overview image display to another frame is in one of eight directions as shown in **FIG. 13**. The user may interact with the video representation of the space one frame at a time. Each individual frame is an image of one of the pictures taken to capture the space as discussed above. The individual frames may be pieced together.

Interacting with a video one frame at a time results in the ability to present a detailed view of the space, but there are severe limitations. First, the interaction results in a form of tunnel vision. The user can only experience the overview image display as it

unfolds a single frame at a time. No provision for viewing an overview or browsing a particular area are provided. Determining where the current location in the image display is, or where past locations were in the overview image display is extremely difficult. Such limitations can be overcome by creating of a motif not dissimilar to the natural feeling a person experiences as one walks into a room.

Another limitation of a simple overview viewer is that there is no random access means. The frames can only be viewed sequentially as the overview image display is unfolded. As adapted for use in accordance with the present invention, this problem has been overcome by providing tools to browse, randomly select and trace selected images associated with any overview image.

FIG. 14 illustrates a prior art overview image **300**, a detail window **310** and a corresponding area indicia, in this case a geometric figure outline **320**. The detail window **310** corresponds to an enlarged image associated with the area bounded by the geometric figure outline **320** in the overview image **300**. As the cursor is moved, the location within the overview image **300** may be highlighted utilizing the geometric figure outline **320** to clearly convey what location the detail window **310** corresponds to.

One of ordinary skill in the computer arts will readily comprehend that reverse videoing the area instead of enclosing it with a geometric figure would

work equally well. Differentiating the area with color could also be used without departing from the invention. A user can select any position within the overview image, press the cursor selection device's button (for example, user controls in the form of touch screen user interface buttons or icons), and an enlarged image corresponding to the particular area in the overview display is presented in the detail window **310**. Thus, random access of particular frames corresponding to the overview image may be provided.

FIG. 15 illustrates a prior art series of saved geometric figure outlines corresponding to user selections in tracing through an overview display for subsequent playback. The overview image **400** has a detail window **410** with an enlarged image of the last location selected in the overview image **470**. Each of the other cursor locations traversed in the overview image **420,430,440,450** and **460** are also enclosed by an outline of a geometric figure to present a trace to the user.

Each of the cursor locations may be saved, and because each corresponds to a particular frame of the overview image, the trace of frames can be replayed at a subsequent time to allow another user to review the frames and experience a similar presentation. Locations in the detailed window and the overview image can also be selected to present other images associated with the image area, but not necessarily formed from the original image.

For example, a china teacup may appear as a dot in

a china cabinet, but when the dot is selected, a detailed image rendering of the china teacup could appear in the detailed window. Moreover, a closed door appearing in an image could be selected and result in a detailed image of a room located behind the door even if the room was not visible in the previous image. Finally, areas in the detailed window can also be selected to enable further images associated with the detailed window to be revealed. Detail of objects within a scene are also dependent on resolution capabilities of a camera. Cameras having appropriate resolution and/or image processing capabilities are preferably used in accordance with certain aspects of the present invention.

The overview image was created as discussed above. To assist one of ordinary skill in the art to make and use the invention, a more detailed discussion of the necessary processing is presented below with reference to **FIG. 16** and **FIG. 17** herein.

FIG. 16 depicts a prior art flowchart providing a logical process for building an overview image display. Such a logical process may be utilized in accordance with the present invention, but is not a necessary feature of the present invention. Those skilled in the art will appreciate that such a logical process can merely an example of one type of image-processing algorithm that may be utilized in accordance with embodiments of the present invention. For example, such a logical process may be implemented as a routine or subroutine that runs via image-processing unit **35** of

FIG. 1 in a hand held device. Those skilled in the art can appreciate that the logical process described with relation to **FIGS. 16** and **17** herein are not limiting features of the present invention.

Such logical processes, rather, are merely one of many such processes that may be utilized in accordance with the present invention to permit a user to manipulate video images displayed via a display screen of a hand held device. Navigable movie/video data in the form of images input to the hand held device to form individual images can be thus processed, as illustrated at function block **500**. User specified window size (horizontal dimension and vertical dimension) may be entered, as illustrated at function block **504**.

Image variables can be specified (horizontal sub-sampling rate, vertical sub-sampling rate, horizontal and vertical overlap of individual frame images, and horizontal and vertical clip (the number of pixels are clipped from a particular frame in the x and y plane)), as depicted at function block **508**. Function blocks **500,504** and **508** are fed into the computation function block **510** where the individual frames are scaled for each row and column, and the row and column variables are each initialized to one.

Then a nested loop can be invoked to create the overview image. First, as indicated at decision block **512**, a test is performed to determine if the maximum number of rows has been exceeded. If so, then the overview image is tested to determine if its quality is

satisfactory at decision block **520**. If the quality is insufficient, the user may be provided with an opportunity to adjust the initial variables, as illustrated at function blocks **504** and **508**. The processing is then repeated. If, however, the image is of sufficient quality, it can be saved and displayed for use, as depicted at block **560**.

If the maximum rows has not been exceeded as detected in decision block **512**, then another test can be performed, as illustrated at decision block **514**, to determine if the column maximum has been exceeded. If so, then the row variable can be incremented and the column variable can be reset to one at function block **518** and control flows to input block **520**. If the column maximum has not been exceeded, then the column variable may be incremented and the sub-image sample frame can be retrieved, as depicted at input block **520**. Then, as illustrated at function block **530**, the frame may be inserted correctly in the overview image.

The frame may be inserted at the location corresponding to (Vsub * row * col)+ Hsub * col; where row and col refer to the variables incremented in the nested loop, and Vsub and Hsub are user specified variables corresponding to the horizontal and vertical sub sampling rate. Finally, the incremental overview image can be displayed based on the newly inserted frame as depicted at display block **540**. Thereafter, the column variable can be reset to one and processing can be passed to decision block **512**.

A computer system corresponding to the prior art method and system depicted in **FIGS. 11** to **17** may be generally interactive. A user may guess at some set of parameters, build the overview image, and decide if the image is satisfactory. If the image is not satisfactory, then variables can be adjusted and the image is recreated. This process can be repeated until a satisfactory image results, which may be saved with its associated parameters. The picture and the parameters can be then input to the next set of logic.

Such features may or may not be present with the hand held device itself. For example, images may be transmitted from a transmitter, such as data transmitter **112** of **FIG. 7**, and subroutines or routines present within the server itself may utilize predetermined sets of parameters to build the overview image and determine if the image is satisfactory, generally at the request of the hand held device user. A satisfactory image can be then transmitted to the hand held device. Alternatively, image-processing routines present within an image-processing unit integrated with the hand held device may operate in association with routines present within the server to determine if the image is satisfactory, and/or to manipulate the image (e.g., pan, zoom).

FIG. 17 depicts a prior art flowchart illustrative of a logical process for playback interaction. The logical process illustrated in **FIG. 17** may be utilized in accordance with preferred embodiments of the present invention. Playback interaction may commence, as

illustrated at label **600**, which immediately flows into function block **604** to detect if user controls have been activated at the hand held device. Such user controls may be configured as external user controls on the hand held device itself (e.g., buttons, etc.), or via a touch screen user interface integrated with hand held device display screen.

When a touch screen user input or user control button press is detected, a test can be performed to determine if a cursor is positioned in the overview portion of the display. If so, then the global coordinates can be converted to overview image coordinates local to the overview image as shown in output block **612**. The local coordinates can be subsequently converted into a particular frame number as shown in output block **614**. Then, the overview image is updated by displaying the frame associated with the particular location in the overview image and control flows via label **600** to function block **604** to await the next button press.

If the cursor is not detected in the overview image as illustrated at decision block **610**, then another test may be performed, as indicated at decision block **620**, to determine if the cursor is located in the navigable player (detail window). If not, then control can be passed back via label **600** to function block **604** to await the next user input. However, if the cursor is located in the detail window, then as depicted a function block **622**, the direction of cursor movement may be detected. As depicted at function block **624**, the nearest frame can

be located, and as illustrated at decision block **626**, trace mode may be tested.

If trace is on, then a geometric figure can be displayed at the location corresponding to the new cursor location in the overview image. The overview image may be then updated, and control can be passed back to await the next user input via user controls at the hand held device and/or a touch screen user interface integrated with the hand held device. If trace is not on, the particular frame is still highlighted as shown in function block **630**, and the highlight can be flashed on the overview image as illustrated at output block **632**. Thereafter, control may be returned to await the next user input.

Although the aforementioned logical processes describe the use of a cursor as a means for detecting locations in a panorama, those skilled in the art can appreciate that other detection and tracking mechanisms may be utilized, such as, for example, the pressing of a particular area within a touch screen display.

FIG. 18 depicts a pictorial representation illustrative of a Venue Positioning System (VPS) **700** in accordance with preferred embodiments of the present invention. **FIG. 18** illustrates a stadium venue **701** which is divided according to seats and sections. Stadium venue **701** may be utilized for sports activities, concert activities, political rallies, or other venue activities. Stadium venue **701** is divided, for example, into a variety of seating sections **A** to **N**. For purposes

of simplifying this discussion, VPS **700** is described in the context of sections **A** to **C** only.

A venue positioning system (VPS) device **704** is positioned in section A of stadium venue **701**, as indicated at position **A2**. A VPS device **702** is located within section **A** at position **A1**. In the illustration of **FIG. 18**, it is assumed that VPS device **702** is located at the top of a staircase, while VPS device **704** is located at the bottom of the staircase, and therefore at the bottom of section A, near the sports field **711**. A VPS device **706** is located near the top of section **B** at position **B1**. A VPS device **708** is located at the bottom of section **B** at position **B2**, near sports field **711**. Similarly, in section **C**, venue positioning devices **710** and **712** are respectively located at positions **C1** and **C2**.

A hand held device **703** may be located at a seat within section **A**. For purposes of this discussion, and by way of example only, it is assumed that hand held device **703** is being operated by a stadium attendee watching a sporting event or other venue activity taking place on sports field **711**. A hand held device **707** is located within section **B**. Hand held device **707**, by way of example, may also be operated by a concessionaire or venue employee.

If the user of hand held device **703** desires to order a soda, hot dog, or other product or service offered by venue operators during the venue event, the user merely presses an associated button displayed via a touch screen user interface integrated with the hand

held device. Immediately, a signal is transmitted by hand held device **703**, in response to the user input to/through the VPS device, wireless network or wireless gateway as previously described. One or more of VPS devices **702**, **704**, **706**, and **708** may detect the signal. The VPS devices may also operate merely as transponders, in which case hand held devices will be able to determine their approximate location within the venue and then transmit position information through wireless means to, for example, concession personnel.

VPS devices **702**, **704**, **706**, and **708** function in concert with one another to determine the location of hand held device **703** within section **A**. Triangulation methods, for example, may be used through the hand held device or VPS devices to determine the location of the hand held device within the venue. This information is then transmitted by one or more of such VPS devices either directly to hand held device **707** or initially through a wireless network, including a wireless gateway and associated server, and then to hand held device **707**. The user of hand held device **707** then can directly proceed to the location of hand held device **703** to offer concession services.

Additionally, hand held device **703** can be configured with a venue menu or merchandise list. In response to requesting a particular item from the menu or merchandise list, the request can be transmitted as wireless data from hand held device **703** through the wireless network to hand held device **707** (or directly to a controller (not shown) of hand held device **707**) so

that the user (concession employee) of hand held device **707** can respond to the customer request and proceed directly to the location of hand held device **703** used by a customer.

FIG. 19 illustrates in greater detail the VPS **700** of **FIG. 18**, in accordance with preferred embodiments of the present invention. In **FIG. 18** and **FIG. 19** like or analogous parts are indicated by identical reference numerals, unless otherwise stated. Additionally wireless gateway **124** and server **100** of **FIG. 19** are analogous to the wireless gateway **124** and server **100** illustrated in **FIG. 8**. Venue positioning units **702, 704, 706,** and **708** are located within section A and section B. A wireless gateway **124** is linked to server **100**. Wireless gateway **124** can communicate with hand held device **707** and hand held device **703**.

Wireless gateway **124** can also communicate with VPS devices **702, 704, 706,** and **708** if the VPS devices are also operating as data communication devices in addition to providing mere transponder capabilities. When VPS devices **702, 704, 706,** and **708** detect the location of hand held device **703** within stadium venue **701,** the location is transmitted to wireless gateway **124** and thereafter to hand held device **703**. It should be appreciated that a hand held device user may also identify his/her location in a venue by entering location information (e.g., seat/section/row) on the hand held device when making a request to a service provider such as a food concession operation. The VPS devices will still be useful to help concession

management locate concession employees located within the venue that are in closest proximity to the hand held device user. A wireless gateway **124** and server **100** can be associated with a wireless network implemented in association with stadium venue **701**. Those skilled in the art will appreciate that such a wireless network may be limited geographically to the stadium venue **701** itself and the immediate surrounding area. An example of such a wireless network, as described previously is a *Bluetooth* based wireless network.

The hand held devices themselves may be proprietary devices owned by promoters or operators of stadium venue **701** and rented to patrons for their use while attending a venue activity. Proprietary devices will generally be manufactured using durable materials (e.g., similar to those materials used on field technician digital multimeters/devices such as the Fluke™ line of electronic devices). Proprietary devices will also be limited in hardware and software modules (i.e., software routines/subroutines) needed for communication with the venue system in order to display venue activities to temporary users.

Hand held devices may also be owned by the patrons themselves which they bring into the stadium venue for their use by permission of the venue promoter or stadium owners in return for the payment of a fee by the patron. In return for the fee, the venue promoter or stadium owner can provide the patron with a temporary code which permits them to access the wireless network associated with the venue itself, such as wireless network **152**

described herein. Patron-owned devices may utilize smart card technology to receive authorization codes (e.g., decryption) needed to receive venue-provided video/data. Codes may also be transferred to the patron-owned device via IR or short range RF means. Wireless network **152** described herein may be configured as a proprietary wireless Intranet/Internet providing other data accessible by patrons through their hand held devices.

FIG. 20 depicts a flowchart of operations **740** illustrative of a method for providing multiple venue activities through a hand held device, in accordance with preferred embodiments of the present invention. The process is initiated, as depicted at block **742**. As illustrated next at block **744**, a venue attendee may activate at least one hand held tuner integrated with a hand held device, such as the hand held device illustrated in **FIG. 4**. At least one tuner may be integrated with the hand held device, although more than one tuner (or other simultaneous signal receiving capability) may be used within a hand held device in support of other embodiments of the invention previously described.

The tuner, or tuners, is/are associated with a transmission frequency/frequencies of a transmitter that may be linked to a particular camera/cameras focusing on a venue activity, or to a wireless gateway or wireless network transmission. To view the images from that particular angle, the user must retrieve the video images from the camera associated with that particular

angle. The user may have to adjust a tuner until the right frequency/image is matched, as indicated at block **756**. As illustrated at block **748**, captured video images are transferred from the video camera to the transmitter associated with the camera, or a server in control of the camera(s). Video images are generally transmitted to the hand held device at the specified frequency, in response to a user request at the hand held device, as depicted at block **750**.

An image-processing unit integrated with the hand held device, as illustrated at block **752** may then process transferred video images. An example of such an image-processing unit is image-processing unit **35** of **FIG. 1**. As indicated thereafter at block **754**, the video images of the venue activity captured by the video camera can be displayed within a display area of the hand held device, such as display **18** of **FIG. 1**. The process can then terminate, as illustrated at block **756**.

FIG. 21 illustrates a flowchart of operations **770** illustrative of a method for providing multiple venue activities through a hand held device from one or more digital video cameras, in accordance with preferred embodiments of the present invention. As indicated at block **772**, the process is initiated. As illustrated next at block **774**, video images of a venue activity may be captured by one or more digital video camera.

Such digital video cameras may be panoramic/wide-angle in nature and/or configured as high definition video cameras, well known in the art. The video camera

or cameras may be respectively linked to data transmitters, such as data transmitters **102**, **104**, **106**, and/or **108** of **FIG. 5** or data transmitter **112** of **FIG. 6** to **FIG. 9** herein. As depicted next at decision block **778**, if a user does not request a view of the venue activity through the hand held device, the process terminates, as illustrated thereafter at block **779**.

If, as illustrated at decision block **778**, the user does request a view of the venue activity through the hand held device, then as described thereafter at block **780**, video data may be transferred from a data transmitter to a server, such as server **100** of **FIG. 5** to **FIG. 8** herein. The video data may be stored in a memory location of the server or a plurality of servers, as indicated at block **782**. The video data may be then transferred to a wireless data transmitter/receiver integrated with the hand held device, as indicated at block **784**.

As illustrated thereafter at block **786**, the video data may be processed by an image-processing unit and associated image-processing routines and/or subroutines integrated with the hand held device. When image-processing is complete, the video images may be displayed in a display area of the hand held device. As illustrated next at block **790**, if a user chooses to pan/zoom for a better view of the video images displayed within the hand held device, then two possible operations may follow, either separately or in association with one another.

The image-processing unit integrated with the hand held device may process the user's pan/zoom request, as illustrated at block **792**. Alternatively, image-processing routines and/or subroutines resident at the server or a plurality of servers may process the user's pan/zoom request, following the transmission of the user's request from the hand held device to the server or plurality of servers. Such a request may be transmitted through a wireless gateway linked to the server or servers.

Image-processing may occur at the server or servers if the hand held device is not capable of directly processing the video data and video images thereof due to low memory or slow CPU allocation. Likewise, some image-processing may take place within the hand held device, while video image-processing requiring faster processing capabilities and increased memory may take place additionally at the server or servers to assist in the final image representation displayed at the hand held device.

When image-processing is complete, the pan/zoomed images can be displayed within a display screen or display area of the hand held device, as illustrated thereafter at block **796**. The process then terminates, as depicted at block **798**. If the user does not request pan/zoom, as indicated at block **790**, the process may then terminate, as described at block **791**.

The embodiments and examples set forth herein are presented in order to best explain the present invention

and its practical application and to thereby enable those skilled in the art to make and utilize the invention. However, those skilled in the art will recognize that the foregoing description and examples have been presented for the purpose of illustration and example only. The description as set forth is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching without departing from the spirit and scope of the following claims.